Real-Time Water Quality Deployment Report

Paddy's Pond

November 25, 2016 to April 19, 2017

Government of Newfoundland & Labrador
Department of Municipal Affairs and Environment
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

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2016-11-25 to 2017-04-19

General

- Department of Municipal Affairs and Environment staff monitors the real-time web pages consistently.
- A malfunction in the QAQC sonde's handheld computer resulted in a lack of QAQC Rankings for removal on April 19th.

Maintenance and Calibration of Instrument

- As part of the Quality Assurance and Quality Control protocol (QAQC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey.
    - Upon deployment, a QA/QC Sonde is temporarily deployed *in situ*, adjacent to the Field Sonde. Depending on the degree of difference between each parameter from the Field and QAQC sondes a qualitative rank is assigned (See Table 1). The possible ranks, from most to least desirable, are: Excellent, Good, Fair, Marginal, and Poor. A grab sample is also taken for additional confirmation of conditions at deployment and to allow for future modelling studies.
    - At the end of a deployment period, a freshly cleaned and calibrated QAQC Sonde is placed *in situ*, adjacent to the Field Sonde. Values are compared between all parameters and differences are ranked for placement in Table 1.

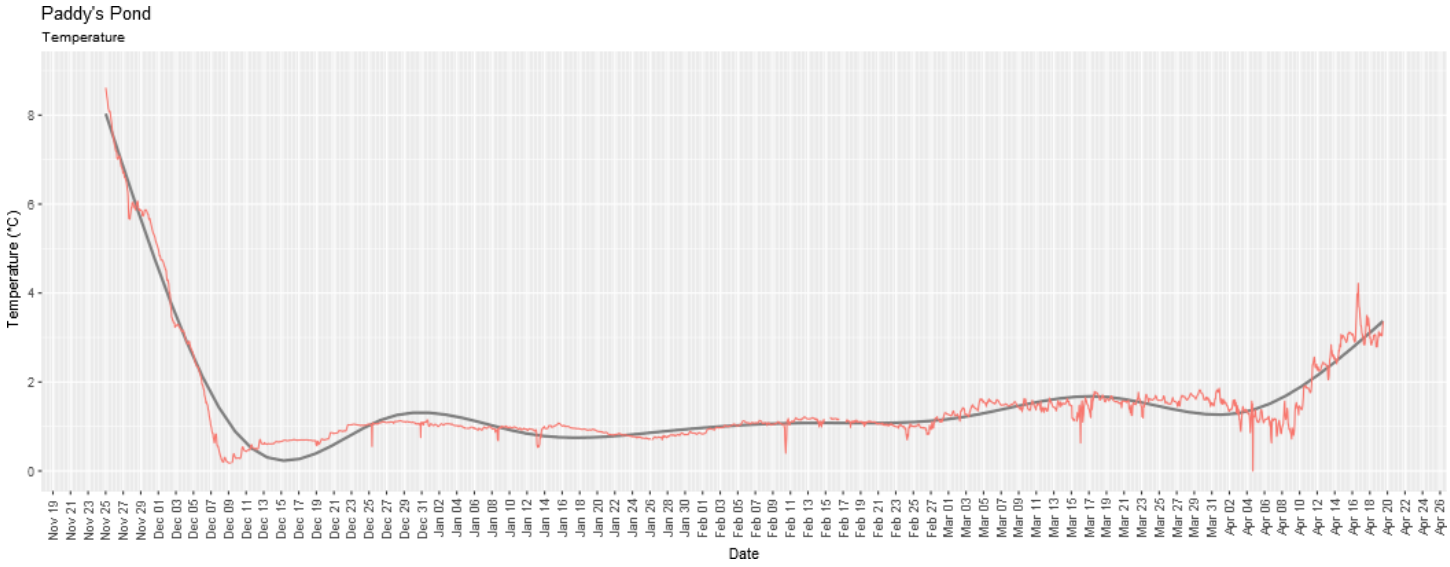
Table 1: Qualitative QAQC Ranking

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Paddy's Pond	November 25, 2016	Deployment	Good	Good	Good	Good	Excellent
	April 19, 2017	Removal	NA	NA	NA	NA	NA

Data Interpretation

Temperature

Water Temperature is a major factor used to describe water quality. Temperature has major implications on both the ecology and chemistry of a water body, governing processes such as the metabolic rate of aquatic plants and animals and the degree of dissolved oxygen saturation.

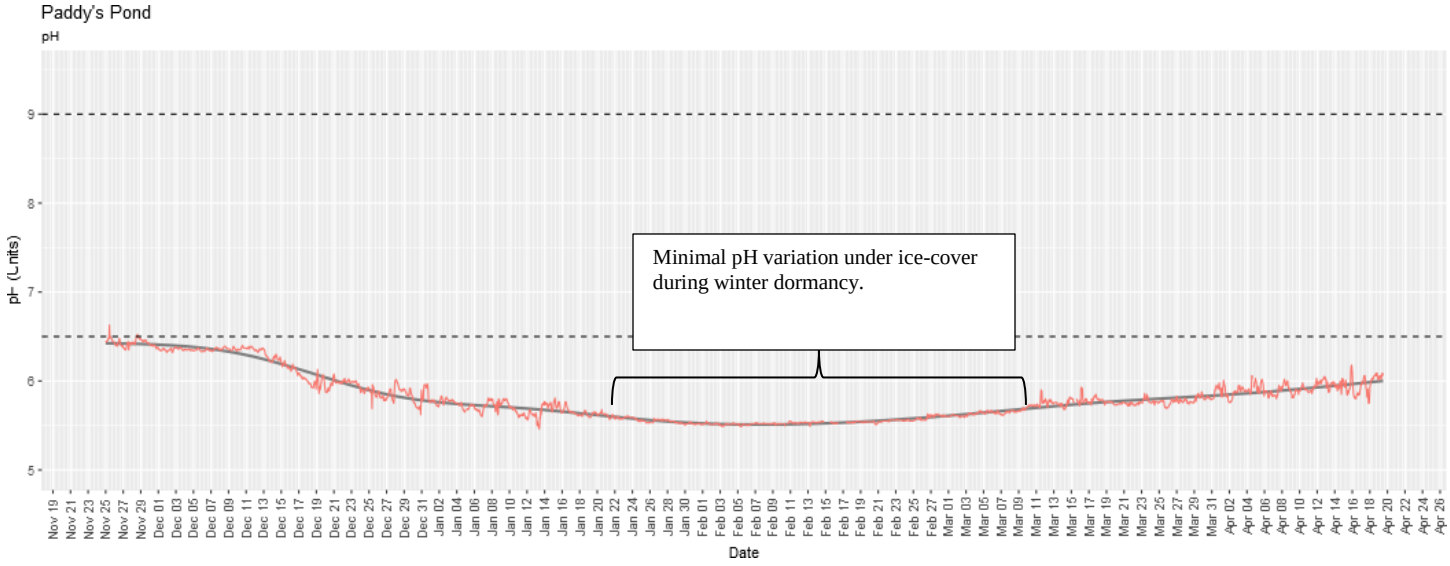


Mean	Median	Min	Max
1.50	1.10	0.00	8.62

- Over this extended period of time, water temperature was consistently coolest early in December with a slow and steady warming trend until late March when spring runoff introduced large quantities of cold water into Paddy's Pond. Shortly thereafter, water temperature began a rise into warmer spring temperatures.

pH

pH is used to give an indication of the acidity or basicity of a solution. A pH of 7 denotes a neutral solution while lower values are acidic and higher values are basic. Technically, the pH of a solution indicates the availability of protons to react with molecules dissolved in water. Such reactions can affect how molecules function chemically and metabolically.

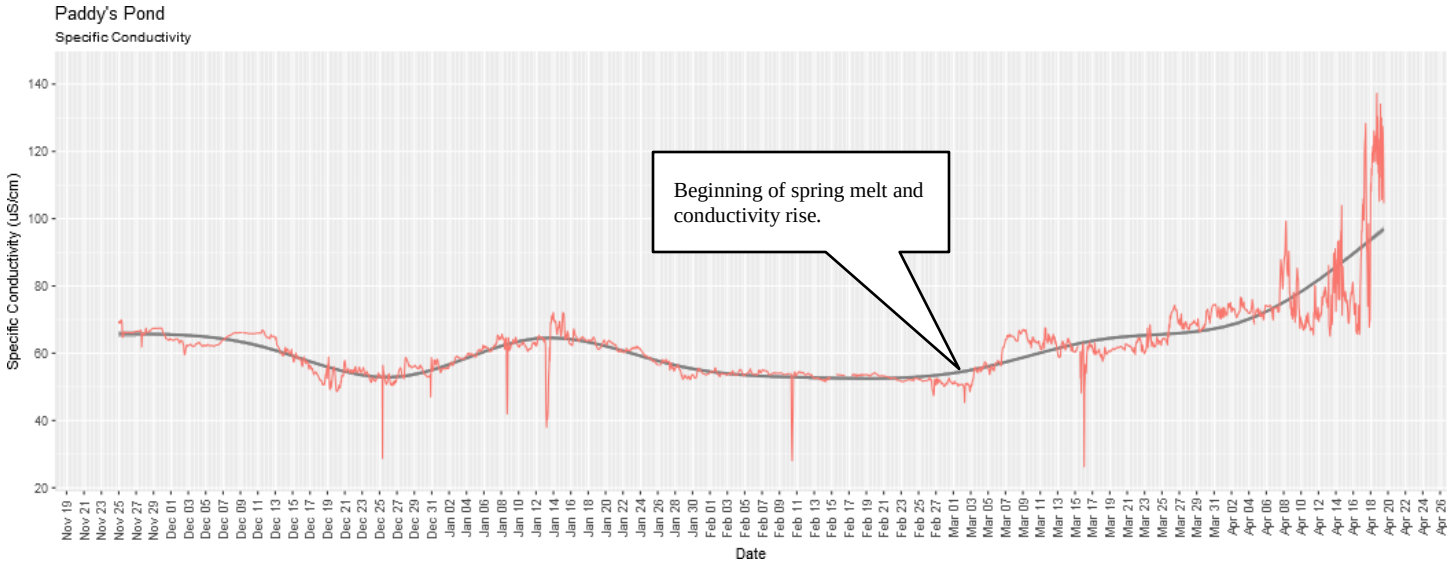


Mean	Median	Min	Max
5.82	5.76	5.46	6.63

- The deployment low of 5.46 occurred during a period of complete ice cover and minimal biological activity within Paddy's Pond. At that time, daily variation in pH was minimal. As ice began to recede, pH variation began to resume and water has trended towards slightly more alkaline conditions.
- The majority of pH levels were found to be below the CCME guideline of 6.5 mg/l for the protection of aquatic life. Newfoundland waters, however, tend to be relatively acidic in nature and the national scope of this guideline results in regular transgression.

Specific Conductivity

Conductivity relates to the ease of passing an electric charge – or resistance – through a solution. Conductivity is highly influenced by the concentration of dissolved ions in solution: distilled water has zero conductivity (infinite resistance) while salty solutions have high conductivity (low resistance). Specific Conductivity is corrected to 25°C to allow comparison across variable temperatures.

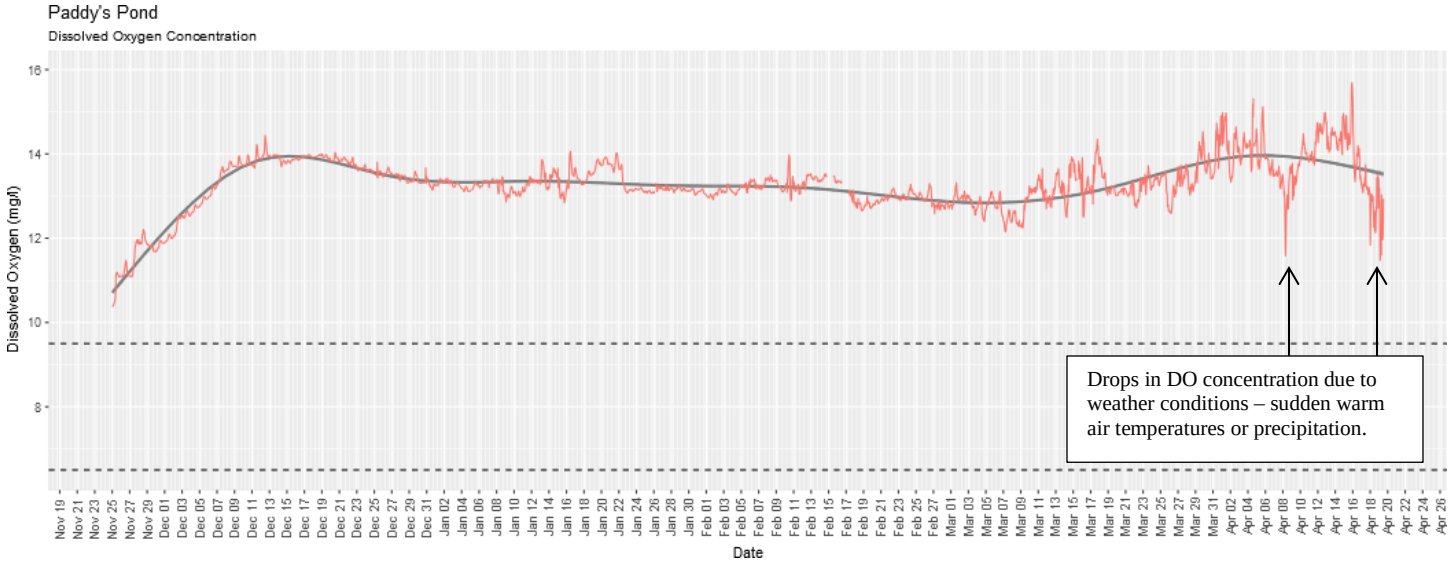


Mean	Median	Min	Max
61.79	61.26	26.26	137.26

- Like, pH, specific conductivity reached a minimum during complete ice coverage as inputs into Paddy's Pond were also at their minimum. As water temperatures increase, however, meltwater brings previously-bound solids into the water body, resulting in a conductivity rise. This is especially pronounced in the latter portion of the deployment period.

Dissolved Oxygen

Dissolved oxygen is a metabolic requirement of aquatic plants and animals. The concentration of oxygen in water depends on many factors, especially temperature – the saturation of oxygen in water is inversely proportional to water temperature. Oxygen concentrations also tend to be higher in flowing water compared to still, lake environments. Low oxygen concentrations can give an indication of excessive decomposition of organic matter or the presence of oxidizing materials.

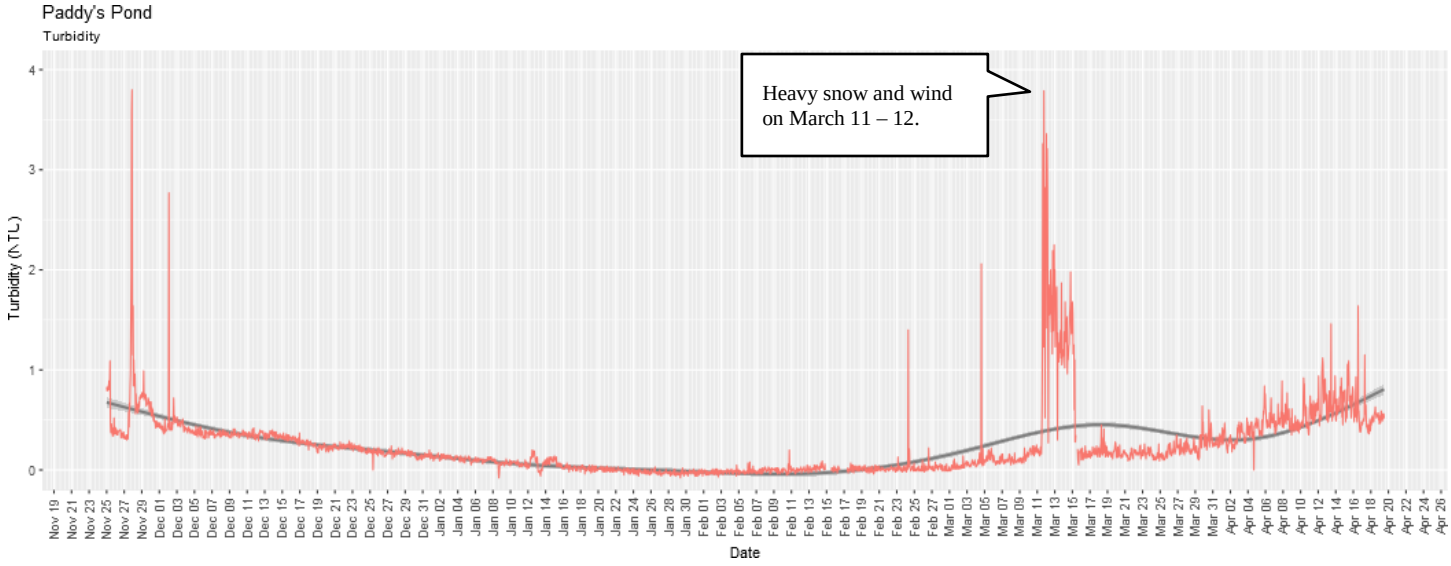


Variable	Mean	Median	Min	Max
DO (mg/l)	13.28	13.27	10.38	15.69
DO ('%-Sat')	94.7	94.0	82.7	116.7

- From November into December, a rapid rise in dissolved oxygen concentration was concurrent with a sharp drop in water temperature. Following this peak, however, oxygen levels slowly dropped into March as water temperature increased slightly under the ice cover. Additional oxygen was likely consumed by aquatic biota over the winter. As ice cover receded in March, atmospheric oxygen became available once again leading to a rise in oxygen levels. As water temperature rises into spring, oxygen levels can be expected to drop.
- All dissolved oxygen values were found to be above the CCME guideline of 9.5 mg/l DO for the protection of early life stage aquatic life (see dashed lines in figure above).

Turbidity

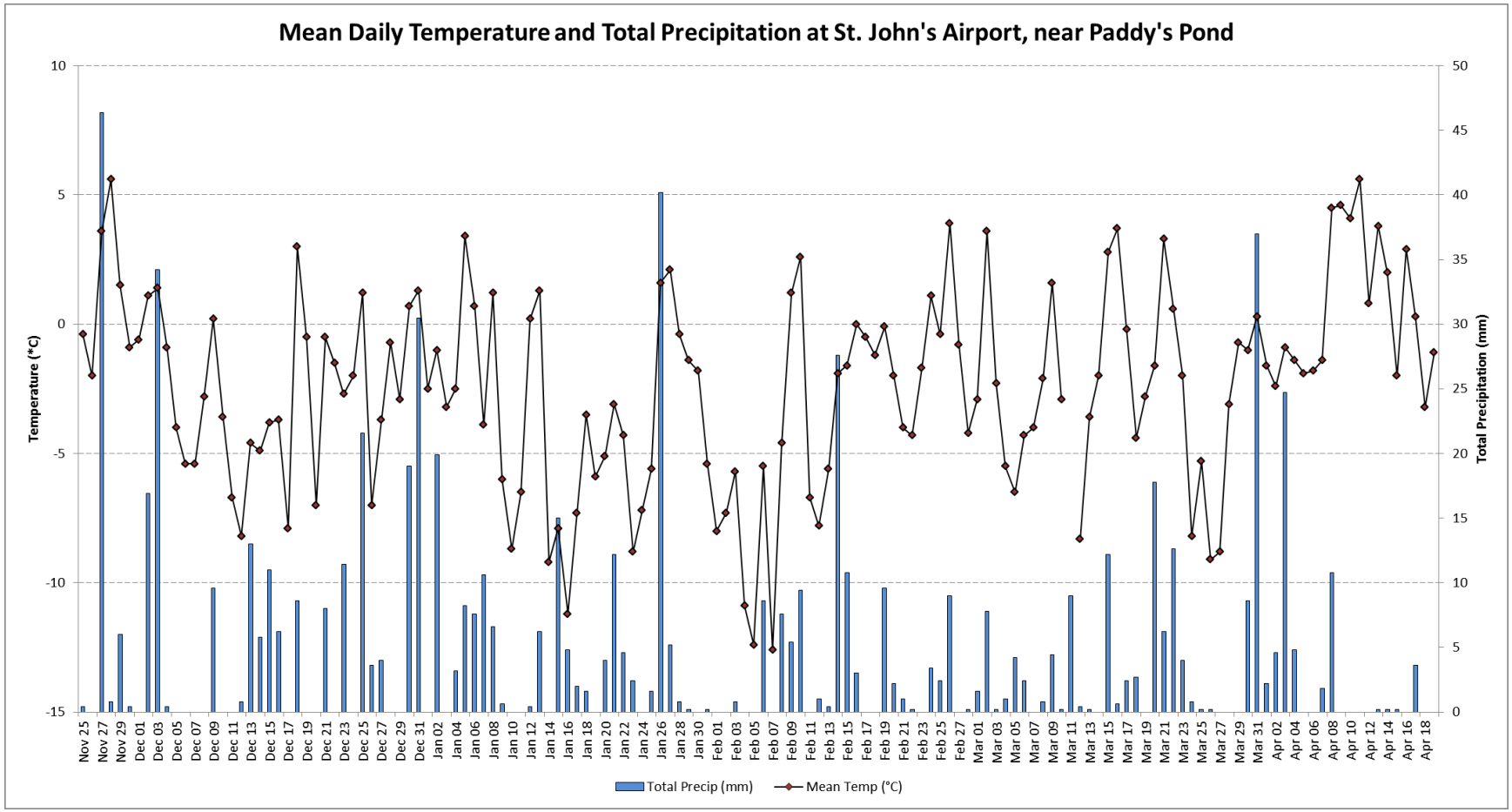
Turbidity is typically caused by fine suspended solids such as silt, clay, or organic material. Consistently high levels of turbidity tend to block sunlight penetration into a waterbody, discouraging plant growth. High turbidity can also damage the delicate respiratory organs of aquatic animals and cover spawning areas.



Mean	Median	Min	Max
0.2	0.2	0.0	3.8

- A very slow decline in turbidity occurred from the onset of winter into mid-late February. As ice cover fully formed, wave action and wind-driven currents within Paddy's Pond were minimized allowing turbidity to drop to 0.0 NTU by mid-deployment. As water temperature began to rise and ice cover receded, turbidity levels began to rise once again.

Appendix


Mean Daily Temperature and Total Precipitation at St. John's Airport, near Paddy's Pond
Temperature (*C)
Total Precipitation (mm)
10
5
0
-5
-10
-15
50
45
40
35
30
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Apr 12
Apr 14
Apr 16
Apr 18
Total Precip (mm)
Mean Temp (°C)